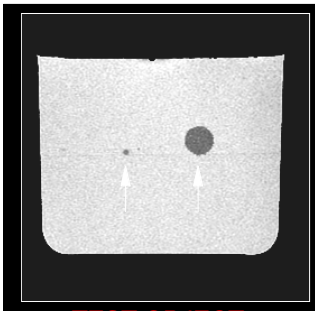
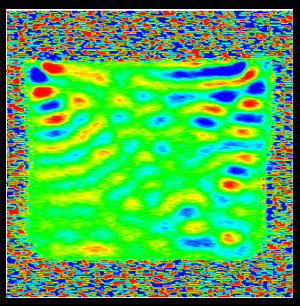
LOCAL MATERIAL PARAMETER INVERSION ALGORITHM



TEST OBJECT



MRI IMAGING OF EXTERNALLY GENERATED STRAIN WAVES

NRL Material Parameter Inversion Algorithm

Displacement $(\vec{u})$ throughout volume

↓

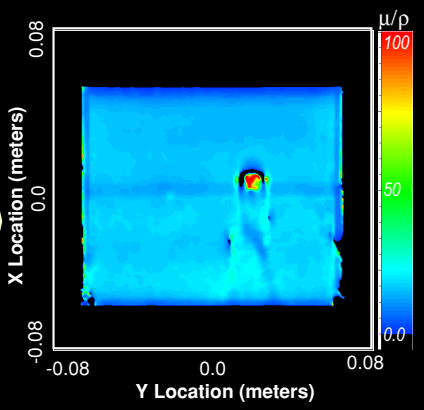
Inversion Process

The variational form of equations of motion is inverted locally in volume element *m*:

$$\int_{\Omega i} \frac{\vec{\vec{I}}(\vec{u})}{\rho} : \vec{\vec{G}}(\vec{v})\, d\Omega = \int_{\Omega i} \omega^2 \vec{u} \cdot \vec{v}\, d\Omega$$

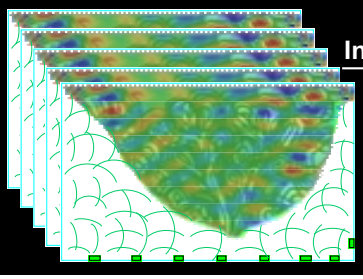
$$(A^T A)^{-1} A^T R = \begin{pmatrix} \left(\frac{\lambda+2\mu}{\rho}\right)_m \\ \left(\frac{\mu}{\rho}\right)_m \end{pmatrix}$$

OUT PUT



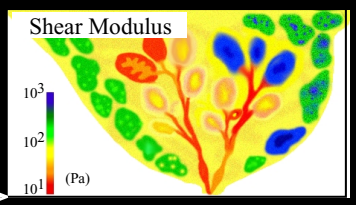
ELASTIC PARAMETER IMAGE

FINAL GOAL:



Input

NRL Material Parameter Inversion Algorithm



Output

The determination of the elastic properties of materials from the spatial distribution of strain resulting from the application of dynamic forces is of interest in a number of disciplines. The most notable examples include clinical medicine, where knowledge of the elastic properties of tissues can contribute to the diagnosis of tumors and other diseases, and non-destructive evaluation, where such information may be used to assess structural integrity. NRL has developed an efficient algorithm for locally inverting interior dynamic displacements to obtain an elastic moduli ratio mapping. The algorithm was recently demonstrated on a cylindrical tissue-like test phantom in which the Mayo Clinic generated interior displacement images using Magnetic Resonance Imaging (MRI).

Points of Contact

Naval Research Laboratory
4555 Overlook Avenue, SW • Washington, DC 20375-5320

Dr. Joseph A. Bucaro • Code 7130 • 202-767-2491
e-mail • jbucaro@ccs.nrl.navy.mil